

## Claims

1. A platform for supporting negotiation between parties to achieve an outcome, the platform comprising:
  - a party goal program unit for:
    - defining respective party's goal program in respect of said outcome, said goal program comprising at least one objective function, having at least one goal expressed by at least one constraint comprising at least one of a deviation variable, a decision variable and a target value, said deviation variable being usable to form said objective function,
    - for associating each of said objective functions with a level of importance, and
    - for assigning each of said goals an importance weighting within its level, and
    - for assigning to deviation variables within each objective function a respective importance weighting, said party goal program unit comprising a party input unit for allowing a party to provide data for a respective goal program,
    - a negotiator associated with said party goal program unit for receiving a goal program of at least one of said respective parties, and carrying out negotiations using said at least one goal program by considering said objective functions levelwise in the respective goal program to approach at said mutually compatible outcome by carrying out minimization at a respective level, therewith to form an offer,
    - an output unit for offering said offer to said respective parties,

a response receiver for receiving from respective parties either counter offers or acceptances, said response receiver being operable to provide counter offers expressed as modified goal programs to said goal program negotiator for further negotiation, said platform advancing to a next level upon an acceptance.

2. The platform of claim 1, further comprising a goal program unifier, associated with said party goal program unit for receiving goal programs of respective parties, and carrying out unification of said goal programs to determine whether two goal programs have a common field of interest from which a mutually compatible outcome is derivable.

3. The platform of claim 1, wherein said party goal program unit comprises a constraint arrangement unit for arranging goal constraints levelwise in a first party's goal program such that conditional weakening from said outcome for a goal in a trade-off involves strengthening of other goals within the same level of said first party.

4. The platform of claim 1, wherein said goal program unit comprises a trade-off unit for arranging goals levelwise in a first party's goal program such that goals of a given level are negotiated with goals of a same level of another party.

5. The platform of claim 1, wherein said party goal program unit is operable to place said objective functions in a hierarchy according to the respective associated level of importance, and to express each goal in terms of at least one decision variable and at least one deviation variable.

6. The platform of claim 5, wherein said party goal program unit is operable to use data from said party data input unit to apply coefficients to said deviation variables.

7. The platform of claim 6, wherein said party goal program unit is operable to apply user input to provide different values of coefficients to said deviation variables for deviations from a corresponding target value in respective positive and negative directions.

8. The platform of claim 7, wherein said party goal program unit is operable to apply said user input to apply said coefficient values to define any one of a group comprising:

- a strong one sided goal,
- a weak one sided goal,
- a complex single sided goal,
- a simple two sided goal,
- a complex two sided goal,
- a simple first side-complex second side goal,
- a simple two-sided goal with an range of indifference,
- a complex two sided goal with an range of indifference, and
- a simple first side-complex second side goal with an indifferent range.

9. The platform of claim 1, wherein at least one goal comprises a series of discrete values.

10. The platform of claim 9, wherein said party goal program unit is operable to apply user input to formulate weightings for respective ones of said discrete values, thereby to express a preference between said discrete values.

11. The platform of claim 5, wherein at least one goal constraint comprises a continuous variable, and wherein said party goal program unit is operable to apply user input to determine whether said at least one of said goal's deviation variables is to be maximized or to be minimized.

12. The platform of claim 5, wherein said negotiator is operable to set a maximum bound per deviation.

13. The platform of claim 5, wherein said negotiator is operable to modify said goal program.

14. The platform of claim 5, wherein said negotiator is operable to modify said goal program by at least one of adding and deleting objective functions.

15. The platform of claim 5, wherein said negotiator is operable to modify said goal program by at least one of adding and deleting constraints.

16. The platform of claim 5, wherein said negotiator is operable based on a received offer, to modify said objective function via respective constraints.

17. The platform of claim 5, wherein said negotiator is operable to carry out minimization for an expression comprising first ones of said deviation variables and then to modify at least one of said constraints for a further minimization stage.

18. The platform of claim 1, wherein said party input unit is configured to receive data from a user interface.

19. The platform of claim 1, wherein said party input unit is configured to receive data from a software agent.

20. The platform of claim 1, wherein said party input unit is operable to identify parameter data missing from an input and wherein said party goal program unit further comprises a default value generator for generating said missing parameter.

21. The platform of claim 1, wherein said party input unit is operable to identify parameter data missing from an input and wherein said party goal program unit further comprises a default register of values for expected parameters, said default register being associated with said party input unit, to provide said missing parameters.

22. The platform of claim 1, wherein said party input unit is operable to request lower and upper bounds for at least some of said decision variables.

23. The platform of claim 22, wherein said party goal program unit further comprises a trade-off unit, said trade-off unit being operable to use said upper and

lower bounds to express deviations of a respective decision variable from a target value relative to an interval defined by said lower and said upper bound, thereby to render said deviations subject to comparison by said negotiator.

24. The platform of claim 1, wherein said party input unit is operable to request a decision variable interval, and a penalty specification for deviating from a target within said interval, and wherein said unifier is operable to define a working interval as an intersection between respective intervals of two parties.

25. The platform of claim 24, wherein said trade-off unit is operable to determine that a target value of one of said objective functions is outside said working interval, and to modify said target value to approach a closest boundary of said working interval.

26. The platform of claim 25, wherein said trade-off unit is operable to apportion said penalty in accordance with said target value modification.

27. The platform of claim 26, wherein said intersection is a point.

28. The platform of claim 26, wherein said party goal program unit comprises operability for determining that an intersection is small to the satisfaction of respective parties and, when said intersection is recognized as small, said negotiator is operable to select a point within said intersection being a midpoint between respective target values.

29. The platform of claim 23, wherein said negotiator is operable to measure deviations within said interval as a fraction of a total size of said interval.

30. The platform of claim 29, wherein said party goal program unit is operable to obtain importance values for deviations from said target and wherein said negotiator is operable to use said importance value as a multiplier to weigh said deviation.

31. The platform of claim 24, wherein said unifier is operable to identify intersections that are small and distant from a target value compared to one of said objective functions and large and inclusive of a target value compared to another of said objective functions, to set an effective target at the closest intersection boundary and to set a transformed deviation as giving an original deviation when multiplied by the effective target and then added to the difference between the old target and the effective target, to produce a result which is divided by the old target.

32. The platform of claim 1, wherein said party input unit is operable to permit a party to define at least one single dimension interval goal in respect of said outcome, and to associate said goal with a range of indifference having an upper bound and a lower bound, a first weighting value for deviations below said lower bound, a second weighting value for deviations above said upper bound and a relative importance for said goal,

said unifier being operable to use said range of indifference, said weightings and said relative importance to unify said at least one goal with at least one other goal to determine said compatibility.

33. The platform of claim 32, wherein said at least one other goal is a corresponding goal in a goal program of an opponent.

34. The platform of claim 1, wherein said party input unit is operable to permit a party to define a two dimensional trade-off goal constraint by entering two two-dimensional points, said party goal program unit being operable to define a trade-off line between said two points.

35. The platform of claim 34, wherein said party input unit is operable to permit a party to define weights for deviation from said trade-off line.

36. The platform of claim 34, said party input unit being operable to permit a party to define a relative importance for said two dimensional trade-off goal constraint.

37. The platform of claim 36, wherein said party input unit is operable to permit a party to associate said two dimensional trade-off goal constraint levelwise with other goal constraints.

38. The platform of claim 37, wherein party enterable weightings, said relative importance, and an associated level are usable by said trade-off unit to insert additional terms to said objective function of a respective level.



39. The platform of claim 1, wherein said party input unit is operable to allow a party to define at least one single dimension two-point goal in respect of said outcome, and to associate said goal with an upper point of preference, and a lower point of preference, a first weighting value for deviations below said lower point of preference, and a second weighting value for deviations above said upper point of preference, said goal program unit being operable to provide a first and a second included weighting to a region included between said points of preference by assigning a first included weighting value below said upper point of preference and a second included weighting value above said lower point of preference and defining an overall weighting within said region as a minimum of said weighting values.

40. The platform of claim 39, wherein said party input unit is operable to permit a party to define a relative importance for said single dimensional two point goal.

41. The platform of claim 40, wherein said party input unit is operable to permit a party to associate said single dimensional two point goal levelwise with other goals.

42. The platform of claim 41, wherein said weights and said relative importance is usable by said trade-off unit to insert additional terms into respective objective functions.

43. The platform of claim 1, wherein said party input unit is operable to permit a user to define a piecewise linear two-dimensional goal by entering at least three

two-dimensional points, said party goal program unit being operable to define a trade-off line between said three points,

said trade-off unit being operable to apply penalty values to points away from said trade-off line in accordance with respective distances from said line.

44. The platform of claim 43, wherein said party input unit is operable to permit a user to define a first deviation weight for deviating in a first direction from said trade-off line and a second deviation weight for deviating in a second direction therefrom.

45. The platform of claim 1, wherein said party input unit is operable to permit parties to define goals comprising pairwise variable trade-offs having at least two points and a trade-off function defined for distance from a line joining said points.

46. The platform of claim 45, wherein said party goal program unit is operable to prevent inconsistent trade-offs to be defined within the platform by preventing said party input unit from accepting more than one trade-off from referring, directly or indirectly, to any given pair of decision variables.

47. The platform of claim 45, wherein said party goal program unit is operable to warn users of inconsistent trade-offs by outputting a warning whenever a trade-off being entered has already been determined directly or indirectly.

48. A platform according to claim 1, wherein said party input unit further comprises a trade-off unit, wherein said party input unit is further operable to allow a

party to define disjunctive constraints in respect of decision variables, and wherein said goal program unit comprises a disjunctive constraint processor, associated with said trade-off unit, for translating a disjunctive expression into a plurality of conjoined expressions, and wherein said unifier is operable to utilize said conjoined expressions to unify said at least one disjunctive constraint with other constraints to determine said compatibility.

49. The platform of claim 48, wherein said disjunctive expression comprises a series of relationships including equality relationships.

50. The platform of claim 49, wherein said disjunctive constraint processor is operable to carry out said translation by expressing at least one of said equality relationships as the union of two corresponding inequalities that meet at a point of equality of said equality relationship.

51. The platform of claim 49, wherein said disjunctive constraint processor is operable to define binary variables for said relationships, for setting wherever said relationships are satisfied, and wherein said negotiator is operable to sum said variables to determine a satisfaction level for said disjunctive constraint.

52. The platform of claim 51, wherein said trade-off unit is operable to set a requirement of a minimum number of satisfied relationships by said negotiator.

53. The platform of claim 1, wherein:

said party input unit is further operable to permit each party to define weighting values for a discrete variable predefined per outcome, for use in said goal program definition, and

said negotiator is operable to carry out negotiation of said goal programs by considering said weighting values to arrive at an outcome comprising an offered one of said values.

54. The platform of claim 53, wherein said party goal program unit is operable to use said weightings for respective values of said discrete variable to arrange values for said variable in an order of desirability, said order being usable by said negotiator to arrive at said offered one of said discrete values.

55. The platform of claim 54, wherein said party goal program unit is operable to use said values and respective weightings and continuous relaxation variables to build summation functions, therefrom to create goal constraints, for use by said platform.

56. The platform of claim 55, wherein said negotiator is operable to attempt offer formation by converting said relaxation variables into binary values, thereby setting one of said binary variables to one and the remainder to zero, and thereby determining said discrete value.

57. The platform of claim 56, wherein said negotiator is operable to reattempt offer formation.

58. The platform of claim 1, wherein said party goal program unit is operable to represent date information as accumulated units of time from a threshold starting date, and further to modify said dates relative to upper and lower bounds entered via said party input unit.

59. The platform of claim 58, wherein said units of time are minutes.

60. A platform according to claim 1, wherein said party input unit is further operable to allow input of variables in association with said objective functions and a linkage between a first and a second of said variables, said linkage defining a trade-off line and deviations thereof with respect to said target values, said negotiator being operable to use said series of variables including said trade-off line to negotiate an outcome in respect of said at least one objective function with other objective functions, thereby to arrive at formation of an offer.

61. The platform of claim 60, further comprising a trade-off unit operable to express said second variable as a function of said first variable, thereby to represent said linkage, and wherein said negotiator is operable to represent deviations from respective target values as deviations from the target value of said first variable.

62. The platform of claim 60, further comprising a trade-off unit operable to express said trade-off as separate deviation variables in respect of said first variable and in respect of said second variable.

63. The platform of claim 60, wherein said trade-off unit is operable to permit an association of a relative importance level to said trade-off.

64. The platform of claim 60, wherein said trade-off unit is operable to calculate a relative importance level for said trade-off as an average of respective relative importance of goals involving said first and second variables.

65. The platform of claim 1, wherein said unifier comprises a goal program generalizer to form a modification of received goal programs for use in said negotiation.

66. The platform of claim 1, wherein said party goal program unit is operable to translate said input received from said party input unit into said objective functions and respective constraints on said objective functions within said goal program, said negotiator comprising an optimizer to find best values for said objective functions and constraints, therewith to obtain a best solution for the goal program for output as a first offer, and then iteratively to produce further solutions until an offer is accepted, thereby to achieve said outcome.

67. The platform of claim 66, wherein said negotiator comprises a percentage modifier for taking ones of said objective functions in turn, and modifying them by a predetermined percentage, thereby to produce said further solutions.

68. The platform of claim 67, wherein said percentage modifier is settable to take each of said objective functions in turn beginning with a most important objective function, until a solution is accepted.

69. The platform of claim 67, wherein said objective functions are arranged in levels and said percentage modifier is settable to take an objective function of a first of said levels only.

70. The platform of claim 66, wherein said negotiator comprises a worst case calculator for determining a worst case level for ones of said objective functions, thereby to obtain a worst acceptable offer.

71. The platform of claim 66, wherein said deviation variables are arranged pairwise, said negotiator comprises an arbitrary case calculator for taking one of each said pair of deviation variables, attaching thereto an arbitrary coefficient, creating therefrom an objective function and using a minimization of said objective function to generate an arbitrary solution.

72. The platform of claim 70, wherein said negotiator further comprises an average case calculator, associated with said optimizer and with said worst case calculator, for

taking said best solution and said worst solution, each solution having corresponding values,

associating ones of said corresponding values, and

constraining variables of said goal program towards an average of each of said corresponding values, therewith to provide an average solution.

73. The platform of claim 72, wherein said goal program objective functions are arranged levelwise and said average case calculator is operable to carry out said associating and said constraining successively levelwise, thereby to produce said series of iterative solutions.

74. The platform of claim 1, wherein said negotiator comprises a solution sorter for comparing goal program solutions by solving said goal program constrained by each one of a series of solutions and ranking the solutions, said negotiator being operable to use said ranking to apply preference to different solutions.

75. The platform of claim 74, wherein said negotiator further comprises a thresholder associated with said solution sorter for applying a threshold to said evaluations to exclude ones of said series of solutions.

76. The platform of claim 75, wherein said solution sorter further comprises a solution completer for applying best values to incompleting variables in incomplete ones of said solutions, thereby to allow said goal program to be evaluated for said incomplete solutions.

77. The platform of claim 74, wherein said solution sorter is settable to find the best solution from said series of solutions by identifying the highest ranked solution and discarding the remaining solutions.



78. The platform of claim 74, wherein said solution sorter comprises a memory, set to hold a predetermined number of solutions, and a comparator to compare a new solution with each solution in said memory, and further comprising a control unit for adding said new solution to said memory if its evaluation is larger than any solution in said memory, and for discarding a lowest ranked solution in said memory.

79. The platform of claim 1, wherein said goal program unit comprises a data input unit for receiving user defined output values, and wherein said goal program unit is operable to set said output values as single value constraints and to flag said constraints as unchangeable.

80. The platform of claim 79, wherein said goal program unit is operable to output an error indicator if said single value constraints render said goal program insoluble.

81. The platform of claim 1, wherein the unifier further comprises a goal program input unit for receiving a local party's goal program and an opponent's goal program to be unified therewith, said goal programs comprising objective functions associated with deviation variables of goal constraints and being arranged in levels, and the negotiator further comprises:

an optimizer for finding best solutions to goal programs, connected to find best values for said objective functions and constraints of said local party's goal program levelwise, and

a worst case calculator for finding worst solutions for goal programs, connected to find worst values for said objective functions and constraints of said opponent's goal program levelwise,

said negotiator being operable to:

use said optimizer and said worst case calculator in succession, level by level to produce successive value sets for evaluation therefrom to form level by level unification offers, and

advance from one level to another level only following acceptance by said parties of a unification offer regarding a previous level.

82. The platform of claim 81, wherein level by level unification offers each comprise an exchange of offers between said parties.

83. The platform of claim 81, wherein said negotiator comprises a constraint updater for updating constraints upon advance from one level to another level in accordance with said respective acceptance.

84. The platform of claim 81, wherein said negotiator comprises a constraint updater for updating goal program constraints.

85. The platform of claim 84, wherein said constraint updater is operable to update goal program objective functions.

86. The platform of claim 81, wherein said negotiator further comprises an offer improver operable to provide an improved offer by making at least one change

in a selected one of said variables to bring about an improvement in the evaluation of the opponent's goal program.

87. The platform of claim 86, wherein said change in said variable is calculated such that said improvement is a predetermined proportion of a difference between a previous offer made and a best possible evaluation made for the opponent.

88. The platform of claim 87, wherein said offer improver is operable to use a value of said selected variable in a last opponent's offer to moderate said change.

89. The platform of claim 87, wherein said offer improver is operable to calculate a protection value, and to use said protection value to limit a reduction in the evaluation of the local party's goal program as a consequence of said improvement to the opponent's goal program evaluation.

90. The platform of claim 89, wherein said protection value is a proportion of the difference between a worst case evaluation of the local party's goal program and an evaluation of a last previous offer thereof.

91. The platform of claim 81, further comprising an offer improver for taking goal program values of a previous local party offer and one value in turn from a previous opponent offer, testing the opponent value against local constraints, and if it fits within the constraints then substituting it into the previous local party offer thereby to provide an improved offer.

92. The platform of claim 1, wherein the negotiator further comprises a goal program input unit for receiving a local party's goal program, said goal program comprising objective functions associated with deviation variables of goal constraints and being arranged in levels, and said negotiator further comprises:

an optimizer for finding best solutions to goal programs, connected to find best values for said objective functions of said local party's goal program levelwise, and

a stay close processor for determining variable improvement directions from monitoring of received offers from said opponent and carrying out value perturbations in said directions,

said negotiator being operable to:

use said optimizer to produce a first offer for a first level,

to advance from one level to another level only following acceptance by said parties of an offer regarding a previous level, and

use said stay close processor to produce a subsequent offer, thereby to arrive at said outcome.

93. The platform of claim 92, wherein said stay close processor is operable for use during offer exchange within a level.

94. The platform of claim 92, wherein said negotiator comprises a constraint updater for updating constraints upon advance from one level to another level in accordance with said respective acceptance.

95. The platform of claim 92, wherein said negotiator further comprises

a gap value determiner, for determining a gap for use in offer improvement,  
and

a value improver, associated with said gap value determiner, for inserting a predetermined proportion of said gap as a constraint of said goal program, and wherein said stay close processor is associated with said value improver thereby to apply a predetermined gap proportion in said direction to provide an improved offer.

96. The platform of claim 95, wherein said stay close processor is operable to monitor two successive opponent offers for value changes therebetween, and to assign to each respective changing variable a weight for use in providing an improved offer, the magnitude of said weight being selected in accordance with a monitored relative size of a corresponding value change of said opponent.

97. The platform of claim 95, wherein said gap is a constant.

98. The platform of claim 97, wherein said constant is a difference between a best value and a worst value of a corresponding variable.

99. The platform of claim 95, wherein said gap is a difference between a last local proposal and a last opponent proposal.

100. The platform of claim 1, further comprising a negotiation necessity tester, associated with said unifier, for joint solving of said local and said other goal program to form a joint goal program comprising optimal solutions for each of said local and said other goal program, said negotiation necessity tester being set to determine

whether there lies a single solution that includes both optimal solutions within said common ground, and if so, to inhibit passing of said goal programs to said negotiator.

101. The platform of claim 1, further comprising a mediation unit callable by both parties levelwise during said negotiations, said mediation unit being operable to retain agreed objective function results of previously solved levels and to apply a summation formula to solve a current level.

102. The platform of claim 101, wherein said summation formula as an objective function is:

$$\left\{ \frac{\sum w_{kj}^+ \cdot \delta_{kj}^+ + \sum w_{kj}^- \cdot \delta_{kj}^-}{\sum w_{kj}^+ + \sum w_{kj}^-} \right\} + \left\{ \frac{\sum v_{kj}^+ \cdot \gamma_{kj}^+ + \sum v_{kj}^- \cdot \gamma_{kj}^-}{\sum v_{kj}^+ + \sum v_{kj}^-} \right\}$$

wherein the respective sides of the summation represent the respective parties, k is a current level, j is used as a running index on deviation variables at said current level, + and – represent respective sides of a target value, w and v are respective parties weighting factors, and  $\delta$  and  $\gamma$  are respective parties deviation variables.

103. The platform of claim 1, further comprising a mediation unit, callable by both parties during said negotiations, said mediation unit being operable to stop operation of said negotiator, apply a summation formula to provide a median solution between respective goal programs, and to provide said median solution as an offer to both parties.

104. The platform of claim 102, wherein each goal program is expressed as a series of decision variables each having an upper bound, a lower bound, a target value and one or more constraints, the platform further comprising a form offer unit for providing a compromise offer to the parties, the unit being operable to assign to each of the goal programs a weighting such that the sum of the weightings is unity for each variable, and to calculate the offer by minimizing relative deviations for each variable over said goal programs weighted according to said assigned weightings.

105. The platform of claim 1, further comprising a discrete variable form offer unit operable to transform values of said discrete variable into a continuous domain, to carry out minimization in light of goal program objective functions of said two parties in said continuous domain, and to transform the minimization results related to the continuous variable back to discrete values, thereby to provide a form offer.

106. The platform of claim 1, further comprising an item catalog for storing a plurality of items to be evaluated in terms of values of said objective functions, wherein said negotiator is operable to provide offers in terms of nearest items in said catalog to user prescribed objective function values.

107. The platform of claim 106, wherein said negotiator comprises:

an item manager for determining which items of said catalog are currently within the scope of negotiations,

a first stage manager, associated with said item manager, for managing levelwise goal program negotiation to successively reduce the number of said items within said scope to a predetermined threshold number of items,

a second stage manager, associated with said item manager, for managing levelwise program negotiation to produce successive offers, and

an item associator, connected to said second stage manager and to said item manager, for expressing said successive offers in terms of items within said scope.

108. The platform of claim 107, wherein said item manager is operable to measure distance from a prescribed specification in terms of a goal program of said prescribing user.

109. The platform of claim 107, wherein said item manager is operable to measure distance from a prescribed specification in terms of a goal program of another prescribing user.

110. The platform of claim 107, wherein said item manager is operable to measure a distance from a prescribed specification in terms of a joint goal program.

111. The platform of claim 107, wherein said item manager is operable to measure distance from a prescribed specification initially in terms of a local goal program, to order said items and iteratively to remove most distant items.

112. The platform of claim 106, comprising compatibility restraints with a second item.

113. The platform of claim 106, comprising compatibility constraints amongst a plurality of items.



114. The platform of claim 106, wherein said negotiator is operable to carry out a semijoin operation to eliminate items of a first type for which no matching items of a second type are available.

115. The platform of claim 106, wherein said negotiator is operable to carry out a semijoin operation to eliminate items of a first type for which no matching items of a plurality of types are available.

116. The platform of claim 1, further comprising an offer delay timer, associated with said negotiator, for introducing determinable delays between issuance of successive offers to an opponent.

117. The platform of claim 116, wherein said offer delay timer is operable to set successively increasing delays.

118. The platform of claim 117, wherein said offer delay timer is operable to set delays to change levelwise.

119. The platform of claim 116, wherein a magnitude of said delay is based on a relative change between succeeding opponent offers.

120. The platform of claim 116, wherein said offer delay timer is operable to set user determined delays.

121. The platform of claim 1, wherein at least one of said goals comprises a dynamically changing value.

122. The platform of claim 1, wherein at least some of said constraints are associated with dynamically changing values.

123. A platform for supporting negotiation between parties to achieve an outcome, the platform comprising:

a party goal program unit comprising a party input unit for allowing each party to define a plurality of goals in respect of said outcome, and to associate each of said goals with a respective level of importance, therefrom to form for each party a goal program,

said party input unit being operable to obtain a target value and upper and lower bounds relating to at least one of said goals, said party goal program unit being operable to use said upper and lower bounds to express deviations from said target values in relative terms, thereby to render deviations from different goals' targets comparable.

124. The platform of claim 123, further comprising a negotiator, operable to define an interval between said upper bound and said lower bound and to measure deviations within said interval as a fraction of a total size of said interval.

125. A platform for supporting negotiation between parties to achieve an outcome, the platform comprising:

a party goal program unit comprising a party input unit for allowing a party to define a plurality of goals in respect of said outcome, and to associate at least one of said goals with a target value, an acceptable interval, and a penalty for deviation from said target value, and

a unifier, for determining common ground between said goal program and at least one other goal program,

and a negotiator, operable to form offers within said common ground by mutual quantifying of an objective function of said at least one goal program with objective function of said at least one other goal program having a target value and an interval, by determining an intersection between said intervals and if said target value is outside said intersection then moving said target value by a deviation amount to a closest boundary of said intersection, said negotiator further being operable to apportion said penalty for deviation amount in accordance with an extent of said deviation of said target value.

126. The platform of claim 125, wherein said intersection is a point.

127. The platform of claim 125, wherein said party goal program unit comprises operability for determining that an intersection is small to the satisfaction of respective parties and, when said intersection is recognized as small, said unifier is operable to select a point within said intersection being a midpoint between respective target values.

128. The platform of claim 125, wherein said negotiator is operable to measure deviations within said interval as a fraction of a total size of said interval.

129. The platform of claim 128, wherein said party goal program unit is operable to obtain importance values for deviations from said target and is further operable to use said importance values as a multiplier to measure said deviation.

130. The platform of claim 125, wherein said party goal program unit further comprises a trade-off unit, said trade-off unit being operable to:

recognize intersections that are small and distant from the target value of said at least one goal and at the same time large and inclusive of a target value of said other goal,

set a unified target at the intervening intersection boundary at a determinable deviation from each target,

calculate the deviation of said unified target from said distant target,

multiply said deviation by a value of the unified target,

add the result of said multiplication to the difference between values of the distant target and the unified target, and

divide the result by a value of the distant target, thereby to produce a transformed deviation value for said at least one goal.

131. The platform of claim 130, wherein said trade-off unit is further operable to normalize said deviation.

132. The platform of claim 130, wherein said trade-off unit is operable to normalize said transformed deviation.

133. The platform of claim 125, further comprising an offer delay timer, associated with said negotiator, for introducing determinable delays between issuance of successive offers to an opponent.

134. The platform of claim 133, wherein said offer delay timer is operable to set successively increasing delays.

135. The platform of claim 134, wherein said offer delay timer is operable to set delays to change levelwise.

136. The platform of claim 133, wherein a magnitude of said delay is based on a relative change between succeeding opponent offers.

137. The platform of claim 133, wherein said offer delay timer is operable to set user determined delays.

138. A platform for supporting negotiation between parties to achieve an outcome, the platform comprising:

a party goal program unit comprising a party input unit for allowing a party to define at least one goal program having a plurality of goals in respect of said outcome, and to associate a goal constraint of at least one of said goals with a range of indifference having an upper bound and a lower bound, a first weighting value for deviations below said lower bound, a second weighting value for deviations above said upper bound and a relative importance for said goal constraints,

and a negotiator, associated with said goal program unit, said negotiator being operable to use said range of indifference, said weightings and said relative importance to obtain an outcome for said at least one goal in view of other goals, by producing successive offers.

139. The platform of claim 138, wherein said party input unit further comprises a prioritizer for allowing said goal to be assigned a level to define a level by level relationship with other objective functions.

140. The platform of claim 139, wherein said party goal program unit further comprises a trade-off unit, said trade-off unit being operable to use said relative importance to establish contributions of deviation variables of respective goal constraints to a corresponding objective function.

141. The platform of claim 138, further comprising an offer delay timer, associated with said negotiator, for introducing determinable delays between issuance of successive offers to an opponent.

142. The platform of claim 141, wherein said offer delay timer is operable to set successively increasing delays.

143. The platform of claim 142, wherein said offer delay timer is operable to set delays to change levelwise.

144. The platform of claim 141, wherein a magnitude of said delay is based on a relative change between succeeding opponent offers.

145. The platform of claim 141, wherein said offer delay timer is operable to set user determined delays.

146. A platform for supporting negotiation between parties to achieve an outcome, the platform comprising:

a party goal program unit comprising a party input unit operable to permit a party to define a two dimensional trade-off goal constraint by entering two two-dimensional points, said party goal program unit being operable to define a trade-off line between said two points, and

a negotiator, associated with said goal program unit, said negotiator being operable to use said trade-off line to solve said goal program containing said at least one trade-off goal constraint taking into account other constraints to arrive at said outcome via a series of successive offers.

147. The platform of claim 146, wherein said party input unit is operable to permit a party to define weights for deviation from said trade-off line.

148. The platform of claim 146, wherein said party input unit is operable to permit a party to define a relative importance for said two dimensional trade-off goal constraint.

149. The platform of claim 148, wherein said party input unit is operable to permit a party to associate said two dimensional trade-off goal constraint levelwise with other goal constraints.

150. The platform of claim 149, wherein said relative importance is usable by said negotiator to establish contributions of deviation variables of respective goal constraints to a corresponding objective function.

151. The platform of claim 146, wherein said party goal program unit further comprises a trade-off line evaluator for assigning a trade-off penalty value to points off said trade-off line.

152. The platform of claim 151, wherein said party goal program unit further comprises a scaling unit, associated with said trade-off line evaluator for scaling said trade-off penalty value, to produce a scaled penalty value.

153. The platform of claim 146, further comprising an offer delay timer, associated with said negotiator, for introducing determinable delays between issuance of successive offers to an opponent.

154. The platform of claim 153, wherein said offer delay timer is operable to set successively increasing delays.

155. The platform of claim 154, wherein said offer delay timer is operable to set delays to change levelwise.



156. The platform of claim 153, wherein a magnitude of said delay is based on a relative change between succeeding opponent offers.

157. The platform of claim 153, wherein said offer delay timer is operable to set user determined delays.

158. A platform for supporting negotiation between parties to achieve an outcome, the platform comprising:

a party goal program unit comprising a party input unit for allowing a party to define at least one single dimension two-point goal constraint in respect of said outcome, and to associate said goal constraint with an upper point of preference, and a lower point of preference, a first weighting value for deviations below said lower point of preference, and a second weighting value for deviations above said upper point of preference, said goal program unit being operable to provide weightings to a region included between said points of preference by assigning said first weighting value below said upper point of preference and said second weighting value above said lower point of preference and defining an overall weighting within said region as a minimum of said weighting values,

and a negotiator, associated with said goal program unit, said negotiator being operable to use said included region, said weightings, and said minimum to consider said at least one goal constraint with other goal constraints to arrive at successive offers to achieve said outcome.

159. The platform of claim 158, wherein said party input unit is operable to permit a party to define a relative importance for said single dimensional two point goal constraint.

160. The platform of claim 159, wherein said party input unit is operable to permit a party to associate said single dimensional two point goal constraint levelwise with other goal constraints.

161. The platform of claim 160, wherein said relative importance is usable by said unifier to establish contributions of deviation variables of respective goal constraints to a corresponding objective function.

162. The platform of claim 158, further comprising an offer delay timer, associated with said negotiator, for introducing determinable delays between issuance of successive offers to an opponent.

163. The platform of claim 162, wherein said offer delay timer is operable to set successively increasing delays.

164. The platform of claim 163, wherein said offer delay timer is operable to set delays to change levelwise.

165. The platform of claim 162, wherein a magnitude of said delay is based on a relative change between succeeding opponent offers.

166. The platform of claim 162, wherein said offer delay timer is operable to set user determined delays.

167. A platform for supporting negotiation between parties to achieve an outcome, the platform comprising:

a party goal program unit comprising a party input unit operable to permit parties to define goal constraints comprising pairwise variable trade-offs having at least two points and a trade-off function for deviating from a line drawn between said points, wherein said party goal program unit is operable to prevent inconsistent inclination values to be defined within the platform by preventing said party input unit from accepting more than one trade-off that refers directly or indirectly to a same pair of variables,

and a negotiator for negotiating with other parties via goal programs to achieve an outcome consistent with said constraints.

168. A platform for supporting negotiation between parties to achieve an outcome, the platform comprising:

a party goal program unit comprising a party input unit operable to permit parties to define constraints relating to pairwise trade-offs having at least two points and a trade-off function for deviations from a line extending therebetween, wherein said party goal program unit is operable to warn users of inconsistent inclination values by outputting a warning whenever a trade-off being entered refers directly or indirectly to a pair of variables already included in a previously entered trade-off, and

a negotiator for negotiating with other goal programs to achieve an outcome consistent with said constraints.

169. A platform for supporting negotiation between parties to achieve an outcome, the platform comprising:

a party goal program unit comprising a party input unit for allowing a party to define at least one objective function in respect of said outcome, and to associate said objective function with a series of variables and disjunctive constraints, said goal program unit comprising a disjunctive constraint processor for translating a disjunctive expression into at least one linear conjunctive expression,

and a negotiator, associated with said goal program unit, said negotiator being operable to use said series of variables including said linear conjunctive expression to negotiate an outcome consistent with said goal program and with other goal programs.

170. The platform of claim 169, wherein said disjunctive expression comprises a series of relationships including equality relationships.

171. The platform of claim 170, wherein said disjunctive constraint processor is operable to carry out said translation by expressing at least one of said equality relationships as the union of two corresponding inequalities that meet at a point of equality of said equality relationship.

172. The platform of claim 170, wherein said disjunctive constraint processor is operable to define binary variables for said relationships, for setting wherever said relationships are satisfied, and wherein said negotiator is operable to sum said variables to determine a satisfaction level for said constraint.

173. The platform of claim 172, wherein said party goal program unit is operable to set a requirement of a minimum number of satisfied relationships for use by said negotiator.

174. A platform for supporting negotiation between parties to achieve an outcome, the platform comprising:

a party goal program unit comprising a party input unit for allowing each party to define a plurality of goals in respect of said outcome, each goal comprising a plurality of deviation variables associated with decision variables, therefrom to form for each party a goal program, wherein a variable having discrete values is predefined, and wherein said party input unit is operable to receive allowed discrete values of said variable for use in said objective function definition,

a unifier, associated with said party goal program unit for receiving goal programs of respective parties, said goals including discrete values of said variable, said unifier being operable to carry out unification of said goal programs by considering said discrete values to arrive at a common region of said discrete variables amongst said goal programs, and

a negotiator operable to utilize fulfillment levels associated with said discrete values to produce successive offers to converge on an outcome within said common region.

175. The platform of claim 174, wherein said party input unit is operable to accept weightings for respective discrete values of said variable, said weightings being usable to arrive at said fulfillment levels.

176. The platform of claim 175, wherein said party goal program unit is operable to use said discrete values and respective weightings to build summation functions, therefrom to express said variable in quantitative manner.

177. The platform of claim 176, wherein said party goal program unit is further operable to normalize said summation function by dividing by a largest one of said weightings.

178. The platform of claim 176, wherein said discrete values comprise binary zero-one variables, said binary zero-one variables serving as multipliers of respective weightings in said summation functions, wherein said negotiator is operable to reach said outcome by setting the binary zero-one variable of one of said discrete values to one and the remainder to zero, and then to calculate said summation functions, thereby to obtain a respective fulfillment level for each goal.

179. The platform of claim 178, wherein said unifier is operable to reattempt unification by setting binary zero-one variables of different ones of said discrete values to one, thereby to find a discrete value of said variable which maximizes said fulfillment levels, for setting as said unified value.

180. The platform of claim 179, wherein said negotiator is operable to use a continuous variable as a transformation of said binary zero-one variables for carrying out said negotiating, said continuous variable being transformable back into said binary zero-one variables to express said outcome.

181. The platform of claim 174, further comprising an offer delay timer, associated with said negotiator, for introducing determinable delays between issuance of successive offers to an opponent.

182. The platform of claim 181, wherein said offer delay timer is operable to set successively increasing delays.

183. The platform of claim 182, wherein said offer delay timer is operable to set delays to change levelwise.

184. The platform of claim 181, wherein a magnitude of said delay is based on a relative change between succeeding opponent offers.

185. The platform of claim 181, wherein said offer delay timer is operable to set user determined delays.

186. A platform for supporting negotiation between parties to achieve an outcome, the platform comprising:

a party goal program unit comprising a party input unit for allowing a party to define at least one objective function and at least one associated goal constraint in respect of said outcome, and to associate said goal constraint with at least two variables, said party input unit further allowing input of a linkage between a first and a second of said variables, said linkage defining a trade-off of deviations with respect to said target values,

a unifier, associated with said goal program unit, said unifier being operable to use said series of variables to unify said at least one goal constraint with other constraints to find a common area of interest, and

a negotiator, associated with said unifier, for using said trade-off to find a mutually acceptable outcome within said common area.

187. The platform of claim 186, wherein at least one of said two variables has a target value.

188. The platform of claim 186, wherein said party goal program unit is operable to express said second variable as a function of said first variable, thereby to represent said linkage, and further to represent deviations from respective target values as deviations from the target value of said first variable.

189. The platform of claim 188, wherein said deviations are weighted.

190. The platform of claim 186, wherein said party goal program unit is operable to express said trade-off as separate deviation variables in respect of said first variable and in respect of said second variable wherein said separate deviation variables are orthogonal.

191. The platform of claim 190, wherein said deviations are weighted.



192. The platform of claim 186, wherein said party input unit is operable to permit an association of a relative importance level to said trade-off, said relative importance level used to calculate contribution to respective objective function.

193. The platform of claim 186, wherein said party goal program unit is operable to calculate a relative importance level for said trade-off as an average of respective relative importance levels of said first and second variables, said relative importance level used to calculate contribution to respective objective function.

194. The platform of claim 186, further comprising an offer delay timer, associated with said negotiator, for introducing determinable delays between issuance of successive offers to an opponent.

195. The platform of claim 194, wherein said offer delay timer is operable to set successively increasing delays.

196. The platform of claim 195, wherein said offer delay timer is operable to set delays to change levelwise.

197. The platform of claim 194, wherein a magnitude of said delay is based on a relative change between succeeding opponent offers.

198. The platform of claim 194, wherein said offer delay timer is operable to set user determined delays.

199. A platform for supporting negotiation between parties to achieve an outcome, the platform comprising:

a party goal program unit for defining goal programs in respect of an outcome, the goal program unit comprising a party input unit for allowing a party to input data relating to said goal program, said goal program unit being operable to translate said values into objective functions and constraints on said objective functions within said goal program,

and a negotiator, associated with said goal program unit, said negotiator comprising an optimizer to find best values for said objective functions under constraints, therewith to obtain a best solution for the goal program for output as a first offer, and then iteratively to produce further solutions until an offer is accepted, thereby to achieve said outcome.

200. The platform of claim 199, wherein said negotiator comprises a percentage modifier for taking ones of said objective functions in turn, and worsening them by a predetermined percentage, thereby to produce said further solutions.

201. The platform of claim 200, wherein said percentage modifier is settable to take each of said objective functions in turn beginning with a most important objective function, until a solution is accepted.

202. The platform of claim 200, wherein said objective functions are arranged in levels and said percentage modifier is settable to take an objective function of a first of said levels only.

203. The platform of claim 199, wherein said negotiator comprises a worst case calculator for determining a worst case evaluation for ones of said objective functions under constraints, thereby to obtain a worst acceptable offer.

204. The platform of claim 199, wherein said goal program contains pairs of bounded deviation variables, and said negotiator comprises an arbitrary case calculator for taking one of each pair of variables, setting it to an arbitrary value within its respective bounds, taking the other of said pair of variables and setting it to zero, therefrom to calculate ones of said iterative solutions.

205. The platform of claim 199, wherein said goal program contains pairs of bounded deviation variables, and said negotiator comprises an arbitrary case calculator for taking one of each pair of variables, associating therewith an arbitrary weight, forming therefrom an objective function as a summation of said arbitrary weights and minimizing of said objective function.

206. The platform of claim 203, wherein said negotiator further comprises an average case calculator, associated with said optimizer and with said worst case calculator, for

taking said best solution and said worst solution, each solution having corresponding values,

associating ones of said corresponding values, and

constraining variables of said goal program towards an average of each of said corresponding values, therewith to provide an average solution.

207. The platform of claim 199, further comprising an offer delay timer, associated with said negotiator, for introducing determinable delays between issuance of successive offers to an opponent.

208. The platform of claim 207, wherein said offer delay timer is operable to set successively increasing delays.

209. The platform of claim 208, wherein said offer delay timer is operable to set delays to change levelwise.

210. The platform of claim 207, wherein a magnitude of said delay is based on a relative change between succeeding opponent offers.

211. The platform of claim 207, wherein said offer delay timer is operable to set user determined delays.

212. The platform of claim 206, wherein said goal program objective functions are arranged levelwise and said average case calculator is operable to carry out said associating and said constraining successively levelwise.

213. The platform of claim 199, wherein said data input unit is operable to receive user defined output values, wherein said goal program unit is operable to set said output values as single value constraints and to flag said constraints as unchangeable.

214. The platform of claim 213, wherein said goal program unit is operable to output an error indicator if said single value constraints render said goal program insoluble.

215. A platform for supporting negotiation between parties to achieve an outcome, the platform comprising:

a party goal program unit for defining goal programs in respect of an outcome, the goal program unit comprising a party input unit for allowing a party to input values, said goal program unit being operable to translate said values into objective functions and constraints on said objective functions within said goal program,

and a negotiator, comprising a solution sorter for comparing goal program solutions by evaluation of said goal program for each one of a series of proposed solutions and ranking the solutions according to said evaluations, said negotiator being operable to use said ranking to apply preference to different solutions.

216. The platform of claim 215, wherein said negotiator further comprises a thresholder associated with said solution sorter for applying a threshold to said evaluations to exclude ones of said series of solutions.

217. The platform of claim 216, wherein said negotiator further comprises a solution completer for applying best values to unspecified values of variables in incomplete ones of said solutions, thereby to allow said goal program to be evaluated for said incomplete solutions.

218. The platform of claim 215, wherein said solution sorter is settable to find the best solution from said series of solutions by identifying the highest ranked solution and discarding the remaining solutions.

219. The platform of claim 215, wherein said solution sorter comprises a memory set to hold a predetermined number of solutions, and a comparator to compare a new solution with each solution in said memory, and further comprising a control unit for adding said new solution to said memory if its evaluation is larger than any solution in said memory, and for discarding a lowest ranked solution in said memory if said memory already contains said predetermined number.

220. The platform of claim 215, further comprising an offer delay timer, associated with said negotiator, for introducing determinable delays between issuance of successive offers to an opponent.

221. The platform of claim 220, wherein said offer delay timer is operable to set successively increasing delays.

222. The platform of claim 221, wherein said offer delay timer is operable to set delays to change levelwise.

223. The platform of claim 220, wherein a magnitude of said delay is based on a relative change between succeeding opponent offers.

224. The platform of claim 220, wherein said offer delay timer is operable to set user determined delays.

225. A platform for supporting negotiation between a local party and an opponent party to achieve an outcome, the platform comprising:

a goal program input unit for receiving a local party's goal program and an opponent's goal program to be unified, said goal programs comprising objective functions associated with constraints and being arranged in successive levels,

an optimizer for finding best solutions to goal programs, connected to find best values for said objective functions and constraints of said local party's goal program levelwise, and

a worst case calculator for finding worst solutions for goal programs, connected to find worst values for said objective functions and constraints of said opponent's goal program levelwise,

said negotiator being operable to:

use said optimizer and said worst case calculator in succession level by level to produce successive best local and worst opponent value sets for evaluation therefrom to form level by level offers, and

to advance from one level to another level only following acceptance by said parties of an offer regarding a previous level.

226. The platform of claim 225, wherein each best local and worst opponent value set is obtained using a current and each remaining successive level.

227. The platform of claim 226, wherein said value sets are obtained while negotiating a current level.

228. The platform of claim 225, wherein said negotiator comprises a constraint updater for updating constraints upon advance from one level to another level in accordance with said respective acceptance.

229. The platform of claim 228, further comprising an offer improver operable to provide an improved offer by making a change in a selected one of said variables to bring about an improvement in the evaluation of the opponent's goal program.

230. The platform of claim 229, wherein said change in said variable is calculated such that said improvement is a predetermined proportion of a difference between a previous offer made and a best possible evaluation made for the opponent.

231. The platform of claim 230, wherein said offer improver is operable to use a value of said selected variable in a last opponent's offer to moderate said change.

232. The platform of claim 230, wherein said offer improver is operable to calculate a protection value, and to use said protection value to limit a reduction in the evaluation of the local party's goal program as a consequence of said improvement to the opponent's goal program evaluation.



233. The platform of claim 232, wherein said protection value is a proportion of the difference between a worst case evaluation of the local party's goal program and an evaluation of a last previous offer thereof.

234. The platform of claim 225, further comprising an offer improver for taking goal program values of a previous local party offer and one value in turn from a previous opponent offer, testing the opponent value against local constraints, and if it fits within the constraints then substituting it into the previous local party offer thereby to provide an improved offer.

235. A platform for supporting negotiation between a local party and an opponent party to achieve an outcome, the platform comprising a negotiator, and a goal program input unit for receiving a local party's goal program, said goal programs comprising objective functions associated with constraints and being arranged in levels,

the negotiator comprising:

an optimizer for finding best solutions to goal programs, connected to find best values for said objective functions under constraints of said local party's goal program levelwise, and

a stay close processor for determining variable improvement directions from monitoring of received offers from said opponent and carrying out value perturbations in said directions,

said negotiator being operable to:

use said optimizer to produce a first offer for a first level,

to advance from one level to another level only following acceptance by said parties of a unification offer regarding a previous level, and  
use said stay close processor to produce a first offer for each subsequent level.

236. The platform of claim 235, wherein said stay close processor is operable to produce successive offers while negotiating within a level.

237. The platform of claim 235, wherein said negotiator comprises a constraint updater for updating constraints upon advance from one level to another level in accordance with said respective acceptance.

238. The platform of claim 235, wherein said negotiator further comprises a gap value determiner for determining a gap for use in offer improvement, and  
a value improver, associated with said gap value determiner, for inserting a predetermined proportion of said gap as a constraint of said goal program, and wherein said stay close processor is associated with said value improver thereby to apply said predetermined gap proportion in said direction to provide an improved offer.

239. The platform of claim 238, wherein said stay close processor is operable to monitor successive opponent offers for value changes therebetween, and to assign to each respective changing variable a weight for use in providing an improved offer, the magnitude of said weight being selected in accordance with a monitored relative size of a corresponding value change of said opponent.

240. The platform of claim 238, wherein said gap is a constant.

241. The platform of claim 240, wherein said constant is a difference between a best value and a worst value of a corresponding variable.

242. The platform of claim 238, wherein said gap is a difference between a local best case and a last opponent proposal.

243. The platform of claim 242, further comprising a gap truncator for maintaining said gap between predetermined maximum and minimum bounds.

244. The platform of claim 235, further comprising an offer delay timer, associated with said negotiator, for introducing determinable delays between issuance of successive offers to an opponent.

245. The platform of claim 244, wherein said offer delay timer is operable to set successively increasing delays.

246. The platform of claim 245, wherein said offer delay timer is operable to set delays to change levelwise.

247. The platform of claim 244, wherein a magnitude of said delay is based on a relative change between succeeding opponent offers.

248. The platform of claim 244, wherein said offer delay timer is operable to set user determined delays.

249. A platform for joint processing of goal programs to produce an outcome, the platform comprising:

- a party goal program unit for formulation of at least one local goal program,
- a unifier for determining common ground between said local goal program and at least one other goal program,
- a negotiation necessity tester, associated with said unifier, for joint solving of said local and said other goal program to form a joint goal program comprising optimal solutions for each of said local and said other goal program, said negotiation necessity tester being set to determine whether there lies a single solution, that is optimal for both parties, within said common ground, and if so, to indicate that no negotiation is necessary.

250. The platform of claim 249, further comprising an output unit for outputting said single solution when negotiation is not necessary.

251. A resource negotiator for making successive offers for usage of a resource with at least one remote party based on a goal program of a local party, the goal program comprising a plurality of objective functions, at least one of said objective functions having a goal associated with a target value, an upper bound, a lower bound and at least one constraint, the resource negotiator comprising:

- an input for receiving data from said remote party,

a minimizer for producing successively worsening minimizations of said goal program, and

an offer formulator, associated with said minimizer, for formulating said minimizations into offers for resource usage for sending to said remote party.

252. The resource negotiator of claim 251, wherein said data from said remote party comprises a goal program comprising a plurality of objective functions, at least some of said objective functions being associated with goal constraints having a target value, an upper bound, a lower bound and at least one constraint, said minimizer for producing successively improving solutions of said remote party goal program, for use together with said worsening minimizations for use by said offer formulator for formulating said offers for resource usage.

253. The resource negotiator of claim 251, wherein said offer formulator comprises a behavior synthesizer for governing said offer formulation in accordance with a predetermined behavior profile.

254. The resource negotiator of claim 253, wherein said behavior profile comprises an opponent offer feedback feature for using opponent offer improvement levels for setting improvement levels for successive offer formulations.

255. The resource negotiator of claim 253, wherein said behavior profile comprises an opponent offer feedback feature for using opponent offer data for setting time intervals for successive offer outputs.

256. The resource negotiator of claim 253, wherein said profile comprises a scenario for a whole negotiation.

257. The resource negotiator of claim 253, wherein said profile is built by said resource negotiator based on input at said input unit.

258. The resource negotiator of claim 253, wherein said behavior profile comprises a negotiation refusal condition for breaking off negotiations when said condition is achieved.

259. The resource negotiator of claim 258, wherein said refusal condition comprises a predetermined number of opponent offers that fail a predetermined improvement threshold.

260. The resource negotiator of claim 258, wherein said refusal condition comprises a predetermined time during which said negotiation fails to reach a predetermined improvement threshold.

261. The resource negotiator of claim 251, wherein said input is operable to receive data from a plurality of remote parties.

262. The resource negotiator of claim 251, further being operable to negotiate with a plurality of parties.

263. The resource negotiator of claim 251, wherein said offers are based on changes to one of said variables only.

264. The resource negotiator of claim 263, comprising a bound setter for setting at least one of respective upper and lower bounds of a respective one of said variables as a function of bounds of other goals in said goal program.

265. The resource negotiator of claim 263, comprising a dynamic bound setter for setting at least one of respective upper and lower bounds of said variable as a function of data received at said input.

266. A resource negotiator for negotiating for usage of a resource with a plurality of remote parties based on a goal program of a local party, the goal program comprising a plurality of objective functions with associated goal constraints, at least one of said goal constraints having at least one variable with an upper bound, and a lower bound, the resource negotiator comprising:

- an input for receiving data from said remote parties,

- an objective function minimizer for calculating a value required to be provided by remote parties of said at least one objective function, and

- an offer acceptor, associated with said minimizer, for receiving offers from said remote parties, comparing said calculation with said offers and for accepting one of said offers based on said minimizations.

267. The resource negotiator of claim 266, wherein said offer acceptor is operable to accept an offer representing a best offer.

268. The resource negotiator of claim 266, wherein said offer acceptor is operable to accept an offer representing a second best offer.

269. The resource negotiator of claim 266, comprising an output for revealing received offers to each of said remote parties.

270. The resource negotiator of claim 266, comprising a bound setter for setting at least one of respective upper and lower bounds of a respective variable as a function of bounds of other constraints in a respective goal program.

271. The resource negotiator of claim 266, comprising a dynamic bound setter for setting at least one of respective upper and lower bounds of said variable as a function of data received at said input.

272. The resource negotiator of claim 266, wherein said minimizer is set to perform minimization over a plurality of objective functions.

273. The resource negotiator of claim 266, wherein said minimizer is set to perform minimization over a single objective function.

274. The resource negotiator of claim 272, wherein said minimizer is set to perform minimization over a penalty function of said objective functions.



275. The resource negotiator of claim 274, further comprising a goal program output unit for sending to said plurality of remote parties at least some of said local party goal program objective functions and associated constraints and variables therewith to enable said remote parties to form or calculate potential offers in light thereof.

276. A resource negotiator for negotiating for usage of a resource with a plurality of remote parties based on a goal program of a local party, the goal program comprising at least one objective function having at least one goal comprising a variable assignable with at least one of an upper bound, and a lower bound, the resource negotiator comprising:

- an active bid monitor for monitoring remote parties remaining in said negotiating,

- a resource quality increaser for successively decreasing a value of said at least one predetermined objective function,

- an offer acceptor, associated with said active bid monitor and with said quality increaser, for ending said negotiation at a time at which only a predetermined number of remote parties remains active, and at a corresponding value of said at least one predetermined objective function, said offer acceptor being operable to deem said negotiation successful if said corresponding value is within any assigned bounds, said predetermined number being related to a number of available resources.

277. The resource negotiator of claim 276, further comprising a bound assigner for calculating at least one bound of said predetermined variable according to other goal constraints of said local goal program.

278. The resource negotiator of claim 276, further comprising a goal program output unit for sending to said plurality of remote parties at least some of said local party goal program objective functions and associated constraints and variables to enable said remote parties to evaluate potential offers in light thereof.

279. The resource negotiator of claim 276, wherein said quality increaser is operable to reduce said value to an intermediate level between a current and a previous level when a number of remaining parties drops from a level above said predetermined number to a level below said predetermined number, thereby to raise said number of remaining parties to correspond with said number of resources.

280. The resource negotiator of claim 279 wherein said predetermined number is one.

281. The resource negotiator of claim 276, wherein said active bid monitor comprises an output unit for revealing to said remote parties a number of remote parties remaining in said negotiating.

282. The resource negotiator of claim 276, wherein said active bid monitor comprises an output unit for revealing to said remote parties identities of remote parties remaining in said negotiating.

283. The resource negotiator of claim 276, wherein said predetermined number is one.

284. The resource negotiator of claim 276, further comprising a drop out decision unit for use by one of said remote parties, said unit comprising:

a current offer evaluator for expressing a current value demand issued by said value increaser in terms of a goal program of said remote party,

an active bid unit for storing the number of remote parties remaining in said negotiating,

a drop out function for calculating a drop out probability as a function of said current value and said number of remote parties remaining in said negotiating, and

a decision maker for using said drop out probability to decide whether to leave said negotiating.

285. A platform for performing ranking between database entries, each of said entries comprising a series of values arranged in fields, the platform comprising:

a goal program unit for taking data from a user and defining therewith a goal program, variables thereof being related to said fields, and

a ranking unit for performing ranking amongst said entries in accordance with said goal program.

286. The platform of claim 285, wherein said goal program unit is operable to take said values in twos, thereby to determine tradeoffs between respective fields.

287. The platform of claim 286, wherein said trade-offs comprise a change in a first of said variables being traded for a proportional indicated change in a second of said variables.

288. The platform of claim 287, wherein said change is one of a group comprising an increase and a decrease.

289. The platform of claim 287, wherein said indicated change is one of a group comprising an increase and a decrease.

290. The platform of claim 285, wherein said goal program unit is operable to take said trade-offs in groups of three or more.

291. The platform of claim 285, wherein said goal program unit is operable to compile statements of a ranking sub-language.

292. The platform of claim 291, wherein said statements comprise at least one of a group comprising: constraint, preference, deviation, and trade-off statements.

293. The platform of claim 291, wherein said goal program unit is operable to take said trade-offs in a plurality of trade-off groups, and to compile a separate trade-off statement for each group.

294. The platform of claim 293, wherein said ranking unit is operable to determine an average of the deviations for each trade-off statement for use in said ranking.

295. The platform of claim 285, wherein said goal program unit further comprises a weight assigner for assigning weights to fields, therewith to perform summation over each of said entries.

296. The platform of claim 295, wherein said weight assigner comprises a user preference input for receiving a user defined preference order between ones of said entries, and wherein said weight assigner is operable to select weights for assignment to fields of said entries such as to enforce said user defined preference.

297. The platform of claim 296, wherein said weight selection is such as to maximize the expression of said user preferences.

298. The platform of claim 295, wherein said fields are ordered preferentially and wherein said weight assigner is operable to assign weights according to a position of a respective field in said order.

299. The platform of claim 296, wherein said weight assigner comprises a user input for receiving a parameter defining a number of entries of high desirability from the start of an ordered list, said weight assigner being operable to select weights to reflect said desirability.

300. The platform of claim 285, comprising a ranking expression unit for providing an expression basis for defining at least one of a group comprising a condition, a deviation, a deviation condition, a constraint, a simple trade-off relationship, a complex trade-off relationship, a preferred value within a range, a

preferred range, a weighting, therefrom to form an objective function for use in said ranking.

301. A platform for supporting negotiation between parties to achieve an outcome, the platform comprising:

an input for receiving an overall deal request from a first party relating to multiple items, and availability data from at least one second party relating to available items,

a deal partitioner for partitioning of said deal request into a plurality of sub-deals each corresponding to at least one item of said sub-deal request that is to be obtained from a single second party, such that said deal request overall is applicable to one or more second parties, and

a deal minimizer for selecting second parties for each sub-deal such as to minimize a cost parameter for said first buyer for said deal request.

302. The platform of claim 301, wherein there are a plurality of said second parties, and each said sub-deal relates to item availability data of a single one of said second parties.

303. The platform of claim 302, wherein a sub-deal comprises a group of items defined by a first party.

304. The platform of claim 302, wherein at least one item is available from a plurality of said second parties.

305. The platform of claim 301, wherein said deal request comprises a specified quantity of a single item.

306. The platform of claim 301, wherein said deal request comprises specified quantities of each of a plurality of items.

307. The platform of claim 301, wherein said deal request comprises items some of which are only available in combinations from at least one of said second parties.

308. The platform of claim 307, wherein said combinations comprise a fixed number of each item of said combination.

309. The platform of claim 307, wherein said combinations comprise a range of number of at least one item of said combination.

310. The platform of claim 301, wherein said cost parameter is expressible via a goal program.

311. The platform of claim 301, wherein said availability data comprises quantity-variable availability data.

312. The platform of claim 301, wherein said deal splitting is carried out using an approximation price-based algorithm.

313. The platform of claim 312, wherein said approximation price-based algorithm is of the residual greedy family.

314. The platform of claim 312, wherein said approximation price-based algorithms include polynomial time approximation scheme-based algorithms.

315. The platform of claim 312, wherein said approximation price-based algorithms are exact algorithms based on linear and integer programming algorithms for use with a limited number of second parties.

316. The platform of claim 312, wherein a number of item types is fixed.

317. The platform of claim 312, wherein a number of parties is fixed.

318. The platform of claim 316, wherein said approximation-based algorithm is a  $(1+\epsilon)$  approximation wherein  $\epsilon$  is a number lying between 0 and 1.

319. The platform of claim 317, wherein said approximation-based algorithm is a  $(1+\epsilon)$  approximation wherein  $\epsilon$  is a number lying between 0 and 1.

320. The platform of claim 312, wherein a number of parties and a number of item types are unbounded.

321. The platform of claim 320, wherein said approximation-based algorithm is a  $(1+\epsilon)$  approximation wherein  $\epsilon$  is a number lying between 0 and 1.



322. The platform of claim 313, wherein said items are available as packages of at least one item and said residual greedy algorithm takes as input a set of all possible packages.

323. The platform of claim 322, wherein said set is subjected to a rounding procedure.

324. The platform of claim 323, wherein said rounded set is subjected to integer knapsack analysis to obtain a minimal cost of obtaining a predetermined number of units.

325. The platform of claim 313, wherein said residual greedy family of algorithms comprises at least a residual greedy algorithm, an improved residual greedy algorithm and a multi-item residual greedy algorithm.

326. The platform of claim 301, wherein said deal partitioner is operable to carry out optimal deal splitting for a single item carried by each of a predetermined maximum number of second parties, each of said second parties presenting to said deal partitioner a quantity-cost table.

327. The platform of claim 326, wherein said deal partitioner is operable to use a polynomial time algorithm to carry out said deal splitting.

328. The platform of claim 301, wherein said deal partitioner is operable to carry out optimal deal splitting for multiple items carried by a predetermined maximum number of second parties, each of said second parties offering at least some of said items and at least some of said suppliers offering items in multi-item packages.

329. The platform of claim 328, wherein said deal partitioner is operable to use a polynomial time algorithm to carry out said deal splitting.

330. The platform of claim 301, wherein there is an unrestricted number of second parties, said platform using a residual greedy approximation algorithm to carry out said deal splitting.

331. The platform of claim 330, wherein at least some of said items are available as multi-item packages.

332. The platform of claim 301, wherein each second party has an unlimited quantity of said at least one item.

333. The platform of claim 332, wherein at least some of said items are available in multi-item packages.

334. The platform of claim 332, wherein said deal splitting is carried out using a pseudo-polynomial time algorithm.

335. The platform of claim 301, wherein each second party has a limited quantity of said at least one item, said deal splitting being carried out using a pseudo-polynomial time algorithm.

336. The platform of claim 335, wherein at least some of said items are available in multi-item packages.